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(Problem 2)

November 1976

Study Plan Summary

John C. Moser - Alexandria, La.

EVALUATION OF PYEMOTES GIGANTICUS N. SP., A POSSIBLE

BIOLOGICAL CONTROL AGENT FOR THE SOUTHERN PINE BEETLE

Pyemotes giganticus attaches and rides the southern pine beetle in laboratory trials. This study will investigate key areas of the mite's life history so that the possibility of field introductions to this area can be evaluated.

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John C. Hosen - Alexandria, La.

IDENTIFICATION OF PYRETHROID RESISTANT N. SP. A POSSIBLE
PHYSIOLOGICAL CONTROL AGENT FOR THE SOUTHERN PINE BEETLE

Pyrethroid resistant attacks and rides the southern pine
beetle in laboratory trials. This study will investigate key
aspects of the beetle's life history so that the possibility of
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(Problem 2)

STUDY PLAN

EVALUATION OF PYEMOTES GIGANTICUS N. SP., A POSSIBLE
BIOLOGICAL CONTROL AGENT FOR THE SOUTHERN PINE BEETLE

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Nov. 11, 1976
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11/15/76
(Date)

STUDY PLAN

EVALUATION OF PYEMOTES GIGANTICUS N. SP., A POSSIBLE
BIOLOGICAL CONTROL AGENT FOR THE SOUTHERN PINE BEETLE^{1/}

By

John C. Moser

The genus *Pyemotes* consists of two basic groups -- those having females with a small claw on leg 1 and those with a large claw. Both groups are obligatory predators of insects. The former has a wide host range, typically attacking stored products insects (and sometimes man), with no species, as yet, demonstrating phoresy. The latter group typically has a narrow host range (usually a single species or genus), prey exclusively on bark beetles, and ride adult hosts as they migrate to fresh trees.

Pyemotes are among the most successful mite predators of bark beetles. Under endemic conditions, they are always present in substantial numbers; but when situations are favorable, they can build up tremendous numbers and decimate bark beetle populations.

Perhaps one reason for the southern pine beetle's (SPB) success is that it has had no naturally associated *Pyemotes*, with the minor exception of *Pyemotes parviscolyti*, a predator of *Pityophthorus bisulcatus* in pine twigs, and which only attacks *D. frontalis* when niches of the two scolytids overlap.

^{1/} *Dendroctonus frontalis* Zimmerman 1868

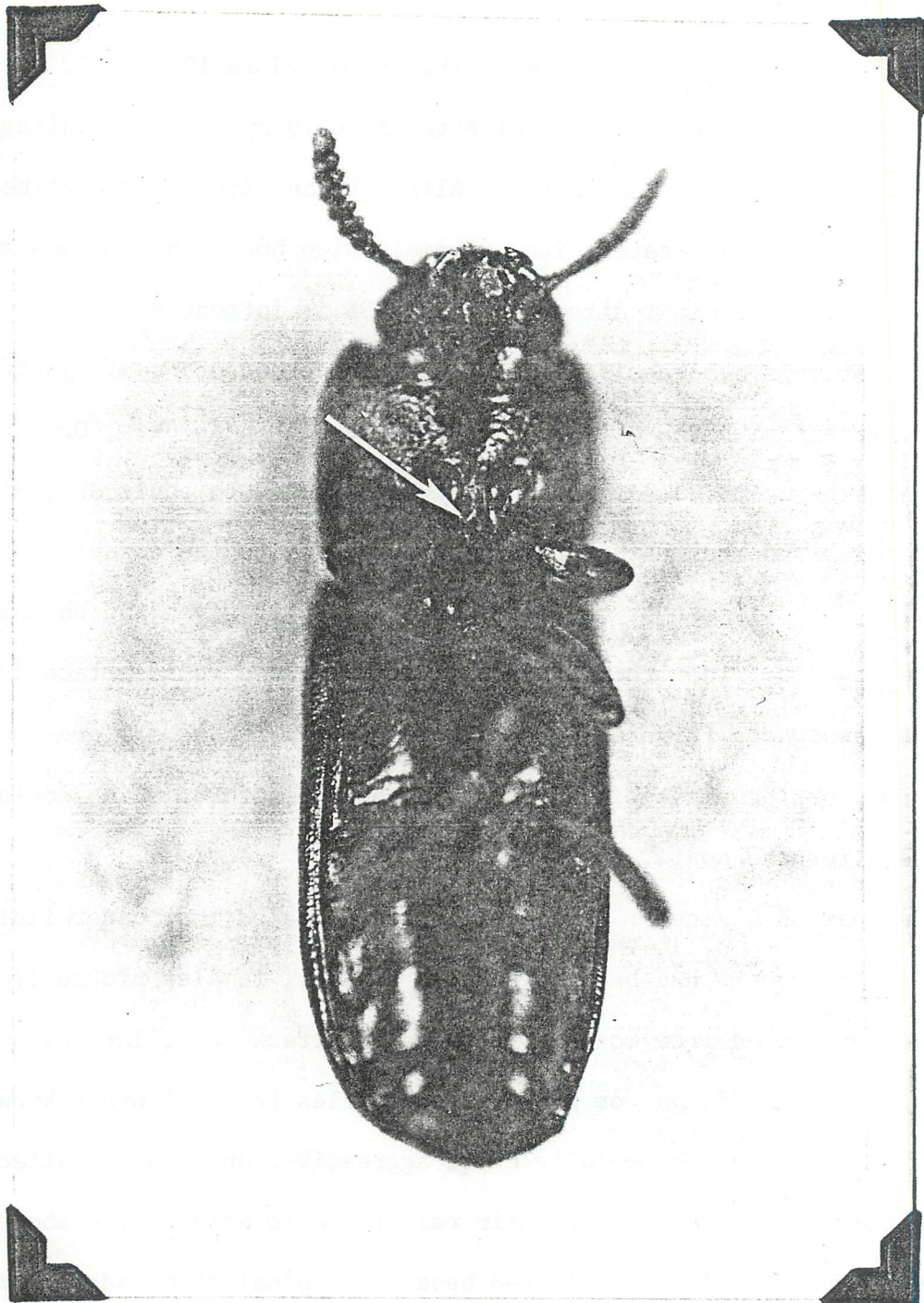
Pyemotes giganticus n. sp. was first recorded in 1966 by D. N. Kinn from 16 species of bark beetles collected from 10 species of conifers in California, Oregon, and Washington. Although the mite seems confined to the western United States, its extremely wide host range raised the possibility that it might attack and ride SPB if introduced.

To test this hypothesis, bolts containing brood of *Pseudohylesinus tsugae* infested with the mite from western hemlock near Otis, Oregon were sent here by Dr. J. A. Rudinsky. When exposed to adult SPB, mite females quickly demonstrated phoresy by attaching to the coxae -- confirming suspicions that the mite would attach if given the chance. The mite may also ride other SPB associates. It was found attached to *Corticus subopacus* (Figure 1) an associate of *P. tsugae*. There are two species of *Corticus* associated with SPB, one or both of which could serve as alternate hosts.

Examination of the *P. tsugae* galleries revealed that under field conditions only eggs had been attacked. However, females picked from galleries or reared from mothers, refused to attack eggs, larvae, or pupae of either *P. tsugae* or SPB. Mated females from all other known species of *Pyemotes* are normally quite aggressive, and readily attack bark beetle brood; (except for their reluctance to attack, the above females of *Py. giganticus* exhibited behavior typical of mated females). Presumably, the attack behavior of *Py. giganticus* is similar to that of *Iponemus*, a related genus of mites that are egg predators of *Ips* spp. In *Iponemus*, phoresy is prerequisite to mated females attacking eggs.

In summary, the fact that *Py. giganticus* readily attaches to SPB adults in the laboratory makes it worth investigating as a possible biological control agent. The purpose of this study, then, is to

FIGURE 1



Female of *Pyemotes giganticus* (arrow) attached in typical phoretic position between coxae 1 of *Corticeus subopacus* a tenebrionid associate of *Pseudohylesinus tsugae* from western hemlock near Otis, Oregon.

investigate key areas of the mite's life history so that the possibility of field introductions to this area can be evaluated.

METHODS AND MATERIALS

As the bolts of western hemlock arrive from Oregon from May through August, bark from half of each bolt will be removed, and galleries of *Pseudohylesinus tsugae* dissected for *Pyemotes giganticus*. Notes will be taken as to where the mites were found, stage of host, number and type of males (normal or heteromorphs) and females (phoretomorphs or heteromorphs), physogastry, and any other pertinent information. Bolt(s) with remaining half of bark will be placed in rearing cans. All insects that emerge will be collected and examined for number and location of phoretic *Py. giganticus* females.

Exploratory studies indicate that laboratory cultures of *Py. giganticus* cannot be perpetuated beyond one generation, because phoresy is prerequisite before newly mated females will attack the host. Furthermore, the mites may feed only on eggs. Females collected from both galleries and from emerged beetles will be given an opportunity to attach to SPB brood adults. On five, freshly cut bolts, 90 cm length and 17 cm diameter, ten pairs of beetles (with one or more females attached to each beetle) will be introduced into each bolt. Bolts will then be placed in rearing cans. Emerging beetles will be collected and checked for number and location of phoretic mites. After all brood adults have emerged from the lab-infested bolts, bark from the bolts will be removed and galleries checked for mite impact on SPB brood. Mites from the

beetles will then be induced to attack SPB eggs, early and late larvae, and pupae in culture dishes.

Since *Py. giganticus* was observed to ride *Corticeus subopacus* reared from *P. tsugae* galleries in western hemlock, this introduces the possibility that one or more bark-beetle associates may serve as vectors of the mite. *Py. giganticus* will be given the opportunity to attach to *Corticeus glaber*, a common SPB associate that is known to host numerous species of phoretic mites. If *C. glaber* is judged a phoretic host, the above rearing experiments with bolts will be repeated. Bolts will be infested with both SPB and *C. glaber*, except that only *C. glaber* will carry the mites. This should demonstrate whether or not *C. glaber* will serve as an alternate mite host. Time and material permitting, other common SPB associates will be bioassayed in like manner.

PRESENTATION OF RESULTS

One or more published papers will be submitted as the final report for this study.

PERSONNEL ASSIGNMENT

John C. Moser

Research Entomologist

Lawrence M. Roton

Biological Laboratory Technician

John Monahan

Biological Laboratory Technician

COOPERATION

Dr. Julius A. Rudinsky, Department Entomology, Oregon State University, Corvallis, Oregon 97331, and his staff have agreed to supply field material of *Pyemotes giganticus* and its host *Pseudohylesinus tsugae*. The proper quarantine permit (form PPQ 526) for interstate movement of these arthropods has been granted by APHIS and the State Entomologist for Louisiana.

Dr. Earle A. Cross, Department Biology, University of Alabama, Tuscaloosa, Alabama 35486, will describe this unique species.

BIOMETRICS REVIEW ROUTING

ROUTING	<div style="border: 1px solid black; padding: 5px; margin: 5px;"> 1. AD-WG </div>	
RESEARCH WORK UNIT	<input checked="" type="checkbox"/> STUDY PLAN <input type="checkbox"/> MANUSCRIPT <input type="checkbox"/> RESPONSE TO BIOMETRICS REVIEW <input type="checkbox"/> _____ FS-SO-2203 -1.38 "Evaluation of <u>Pyemotes giganticus</u> n. sp., a possible ^(OTHER) biological control agent for the southern pine beetle". <hr/> <div style="display: flex; justify-content: space-between;"> (STUDY NUMBER) (TITLE) </div> <hr/> <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> (AUTHOR SIGNATURE) <u>John C. Moser</u> John C. Moser </div> <div style="width: 35%;"> (DATE) 11/11/76 </div> </div> <hr/> REMARKS: <i>The study plan does not call for statistical analysis of data, therefore I suggest that Biometrics review be waived.</i>	
	SUBMITTED: <u>Peter L. Lorio, Jr.</u> <div style="display: flex; justify-content: space-between;"> (PROJECT LEADER SIGNATURE) Peter L. Lorio, Jr. (DATE) 11/11/76 </div>	
AD	<input type="checkbox"/> FORWARDED FOR BIOMETRICS REVIEW <input checked="" type="checkbox"/> BIOMETRICS REVIEW WAIVED <hr/> <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> (ASSISTANT DIRECTOR SIGNATURE) <u>M. Hannon</u> </div> <div style="width: 35%;"> (DATE) 11/17/76 </div> </div>	
BIOMETRICS SERVICES	<input type="checkbox"/> NO COMMENTS <input type="checkbox"/> COMMENTS BELOW <input type="checkbox"/> COMMENTS ATTACHED <input type="checkbox"/> COMMENTS MADE BY PHONE <hr/> <div style="display: flex; justify-content: space-between;"> (BIOMETRICIAN SIGNATURE) (DATE) </div> <hr/> COMMENTS:	IN _____ OUT _____
INSTRUCTIONS	1. Project Leader must submit this form with each study plan. Also use this form when manuscripts are submitted for review. 2. Insert desired "Routing" in space at top of form. 3. Be sure to insert proper identification in the "Research Work Unit" block. 4. Completed copies of this form will be filed in the study file in the Assistant Director's and Project Leader's files.	
	ORIGINAL - RESEARCH WORK UNIT FILE	

